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<110> E. I. du Pont de Nemours and Company
<120> Genes Encoding Sulfate Assimilation Proteins
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<150> 60/092,833
<151> July 14, 1998

<160> 8

<170> Microsoft Office 97

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<211> 2327
<212> DNA
<213> Oryza sativa

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 <211> 673
 <212> PRT
 <213> Oryza sativa

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Met Ser Ala Ala Val Gly Gly Ala Glu Phe His Gly Phe Arg Gly Gly
 35 40 45

Gly Gly Gly Ala Ala Gln Leu Gln Arg Ser Arg Met Leu Gly Arg Pro
 50 55 60

Leu Arg Val Ala Thr Pro His Ala Ala Ala Pro Ala Gly Gly Gly
 65 70 75 80

Ser Ser Ser Ala Ser Ile Arg Ala Val Ser Ala Pro Leu Lys Lys Asp
 85 90 95

Ala Ser Glu Val Lys Arg Ser Lys Val Glu Ile Ile Lys Glu Lys Ser
 100 105 110

Asn Phe Leu Arg Tyr Pro Leu Asn Glu Glu Leu Val Ser Glu Ala Pro
 115 120 125

Asn Ile Asn Asp Ser Ala Val Gln Leu Ile Lys Phe His Gly Ser Tyr
 130 135 140

Gln Gln Thr Asp Arg Asp Val Arg Gly Gln Lys Asn Tyr Ser Phe Met
 145 150 155 160

Leu Arg Thr Lys Asn Pro Cys Gly Lys Val Pro Asn Gln Leu Tyr Leu
 165 170 175

Ala Met Asp Thr Leu Ala Asp Glu Phe Gly Ile Gly Thr Leu Arg Leu
 180 185 190

Thr Thr Arg Gln Thr Phe Gln Leu His Gly Val Leu Lys Lys Asn Leu
 195 200 205

Lys Thr Val Ile Ser Thr Val Ile Lys Asn Met Gly Ser Ser Leu Gly
 210 215 220

Ala Cys Gly Asp Leu Asn Arg Asn Val Leu Ala Pro Ala Ala Pro Tyr
 225 230 235 240

Val Arg Lys Asp Ile Leu Phe Ala Gln Glu Thr Ala Glu Asn Ile Ala
 245 250 255

Ala Leu Leu Thr Pro Gln Ser Gly Ala Tyr Tyr Asp Leu Trp Val Asp
 260 265 270

Gly Glu Lys Ile Met Ser Ala Glu Glu Pro Pro Glu Val Thr Lys Ala
 275 280 285
 Arg Asn Asp Asn Thr Tyr Gly Thr Asn Phe Pro Asp Ser Pro Glu Pro
 290 295 300
 Ile Tyr Gly Thr Gln Tyr Leu Pro Arg Lys Phe Lys Ile Ala Val Thr
 305 310 315 320
 Val Ala Gly Asp Asn Ser Val Asp Ile Leu Thr Asn Asp Ile Gly Val
 325 330 335
 Val Val Val Ser Asp Ser Ala Gly Glu Pro Val Gly Phe Asn Ile Tyr
 340 345 350
 Val Gly Gly Gly Met Gly Arg Thr His Arg Val Glu Thr Thr Phe Pro
 355 360 365
 Arg Leu Ala Asp Pro Leu Gly Tyr Val Pro Lys Glu Asp Ile Leu Tyr
 370 375 380
 Ala Ile Lys Ala Ile Val Val Thr Gln Arg Glu Asn Gly Arg Arg Asp
 385 390 395 400
 Asp Arg Arg Tyr Ser Arg Met Lys Tyr Leu Ile Asp Asn Trp Gly Ile
 405 410 415
 Glu Lys Phe Arg Ala Glu Val Glu Lys Tyr Tyr Gly Lys Lys Phe Glu
 420 425 430
 Asp Ser Arg Pro Leu Pro Glu Trp Gln Phe Asn Ser Tyr Leu Gly Trp
 435 440 445
 Gln Glu Gln Gly Asp Gly Lys Leu Phe Tyr Gly Val His Val Asp Asn
 450 455 460
 Gly Arg Val Ala Gly Gln Ala Lys Lys Thr Leu Arg Glu Ile Ile Glu
 465 470 475 480
 Lys Tyr Asn Leu Glu Val Ser Ile Thr Pro Asn Gln Asn Leu Ile Leu
 485 490 495
 Cys Gly Ile Asp Gln Ala Trp Lys Asp Pro Ile Thr Ala Ala Leu Ala
 500 505 510
 Gln Ser Gly Leu Leu Glu Pro Lys Asp Val Asp Pro Leu Asn Ile Thr
 515 520 525
 Ser Met Ala Cys Pro Ala Leu Pro Leu Cys Pro Leu Ala Gln Thr Glu
 530 535 540
 Ala Glu Arg Gly Ile Leu Pro Ile Leu Lys Arg Ile Arg Ala Val Phe
 545 550 555 560
 Asp Lys Val Gly Ile Lys Asp His Glu Ser Val Val Val Arg Ile Thr
 565 570 575
 Gly Cys Pro Asn Gly Cys Ala Arg Pro Tyr Met Ala Glu Val Gly Phe
 580 585 590

Val Gly Asp Gly Pro Asn Ser Tyr Gln Ile Trp Leu Gly Gly Thr Pro
595 600 605

Asn Gln Ser Thr Leu Ala Glu Thr Phe Met Asn Lys Val Lys Leu Gln
610 615 620

Asp Ile Glu Lys Val Leu Glu Pro Leu Phe Ser Tyr Trp Asn Ser Thr
625 630 635 640

Arg Gln Glu Gly Glu Ser Phe Gly Ser Phe Thr Arg Arg Thr Gly Phe
645 650 655

Asp Lys Leu Lys Glu Val Val Asn Lys Trp Ala Glu Ser Ala Ser Ala
660 665 670

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<212> DNA
<213> Glycine max

<400> 3
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tctccctcc ttcatccact cgctctctt ccctcatacg tgctgtttcc acgcctgcgc 180
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ggattttgt 2408

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<212> PRT
<213> Glycine max

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35 40 45

Leu Ser Leu Ile Arg Ala Val Ser Thr Pro Ala Gln Ser Glu Thr Ala
50 55 60

Thr Val Lys Arg Ser Lys Val Glu Ile Phe Lys Glu Gln Ser Asn Phe
65 70 75 80

Ile Arg Tyr Pro Leu Asn Glu Asp Ile Leu Thr Asp Ala Pro Asn Ile
85 90 95

Ser Glu Ala Ala Thr Gln Leu Ile Lys Phe His Gly Ser Tyr Gln Gln
100 105 110

Tyr Asn Arg Glu Glu Arg Gly Ser Arg Ser Tyr Ser Phe Met Ile Arg
115 120 125

Thr Lys Asn Pro Cys Gly Lys Val Ser Asn Gln Leu Tyr Leu Thr Met
130 135 140

Asp Asp Leu Ala Asp Gln Phe Gly Ile Gly Thr Leu Arg Leu Thr Thr
145 150 155 160

Arg Gln Thr Phe Gln Leu His Gly Val Leu Lys Lys Asp Leu Lys Thr
165 170 175

Val Met Gly Thr Ile Ile Arg Asn Met Gly Ser Thr Leu Gly Ala Cys
180 185 190

Gly Asp Leu Asn Arg Asn Val Leu Ala Pro Ala Ala Pro Leu Ala Arg
195 200 205

Lys Asp Tyr Leu Phe Ala Gln Gln Thr Ala Glu Asn Ile Ala Ala Leu
210 215 220

Leu Ala Pro Gln Ser Gly Phe Tyr Tyr Asp Ile Trp Val Asp Gly Glu
225 230 235 240

Lys Ile Leu Thr Ser Glu Pro Pro Glu Val Val Gln Ala Arg Asn Asp
245 250 255

Asn Ser His Gly Thr Asn Phe Pro Asp Ser Pro Glu Pro Ile Tyr Gly
 260 265 270
 Thr Gln Phe Leu Pro Arg Lys Phe Lys Ile Ala Val Thr Val Pro Thr
 275 280 285
 Asp Asn Ser Val Asp Ile Leu Thr Asn Asp Ile Gly Val Val Val Val
 290 295 300
 Thr Asp Asp Asp Gly Glu Pro Gln Gly Phe Asn Ile Tyr Val Gly Gly
 305 310 315 320
 Gly Met Gly Arg Thr His Arg Leu Glu Thr Thr Phe Pro Arg Leu Ala
 325 330 335
 Glu Pro Ile Gly Tyr Val Pro Lys Glu Asp Ile Leu Tyr Ala Val Lys
 340 345 350
 Ala Ile Val Val Thr Gln Arg Glu Asn Gly Arg Arg Asp Asp Arg Lys
 355 360 365
 Tyr Ser Arg Leu Lys Tyr Leu Ile Ser Ser Trp Gly Ile Glu Lys Phe
 370 375 380
 Arg Ser Val Val Glu Gln Tyr Tyr Gly Lys Lys Phe Glu Pro Phe Arg
 385 390 395 400
 Ala Leu Pro Glu Trp Glu Phe Lys Ser Tyr Leu Gly Trp His Glu Gln
 405 410 415
 Gly Asp Gly Lys Leu Phe Tyr Gly Leu His Val Asp Asn Gly Arg Ile
 420 425 430
 Gly Gly Asn Met Lys Lys Thr Leu Arg Glu Val Ile Glu Lys Tyr Asn
 435 440 445
 Leu Asn Val Arg Ile Thr Pro Asn Gln Asn Ile Ile Leu Thr Asp Val
 450 455 460
 Arg Ala Ala Trp Lys Arg Pro Ile Thr Thr Thr Leu Ala Gln Ala Gly
 465 470 475 480
 Leu Leu Gln Pro Arg Phe Val Asp Pro Leu Asn Ile Thr Ala Met Ala
 485 490 495
 Cys Pro Ala Phe Pro Leu Cys Pro Leu Ala Ile Thr Glu Ala Glu Arg
 500 505 510
 Gly Ile Pro Asn Ile Leu Lys Arg Ile Arg Asp Val Phe Asp Lys Val
 515 520 525
 Gly Leu Lys Tyr Ser Glu Ser Val Val Val Arg Ile Thr Gly Cys Pro
 530 535 540
 Asn Gly Cys Ala Arg Pro Tyr Met Ala Glu Leu Gly Leu Val Gly Asp
 545 550 555 560
 Gly Pro Asn Ser Tyr Gln Ile Trp Leu Gly Gly Asn His Lys Gln Thr
 565 570 575

Ser Leu Ala Arg Ser Phe Met Asp Arg Val Lys Ile Leu Asp Leu Glu
580 585 590

Lys Val Leu Glu Pro Leu Phe Tyr Tyr Trp Lys Gln Lys Arg Gln Ser
595 600 605

Lys Glu Ser Phe Gly Asp Phe Thr Asn Arg Met Gly Phe Glu Lys Leu
610 615 620

Lys Glu Tyr Ile Glu Lys Trp Glu Gly Pro Val Val Ala Pro Ser Arg
625 630 635 640

His Asn Leu Lys Leu Phe Ala Asp Lys Glu Thr Tyr Glu Ser Met Asp
645 650 655

Ala Leu Ala Lys Leu Gln Asn Lys Thr Ala His Gln Leu Ala Met Glu
660 665 670

Val Ile Arg Asn Tyr Val Ala Ser Asn Gln Asn Gly Lys Gly Glu
675 680 685

<210> 5

<211> 1152

<212> DNA

<213> Triticum aestivum

<400> 5

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<211> 286

<212> PRT

<213> Triticum aestivum

<400> 6

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Arg Ala Glu Ala Glu Lys Tyr Tyr Gly Lys Lys Phe Glu Asp Phe Arg
 35 40 45

Pro Leu Pro Glu Trp Gln Phe Asn Ser Tyr Leu Gly Trp Gln Glu Gln
 50 55 60

Gly Asp Gly Lys Leu Phe Tyr Gly Val His Val Asp Asn Gly Arg Leu
 65 70 75 80

Gly Gly Gln Ala Lys Lys Thr Leu Arg Glu Ile Ile Glu Lys Tyr Ser
 85 90 95

Leu Asp Val Ser Ile Thr Pro Asn Gln Asn Leu Ile Leu Cys Gly Val
 100 105 110

Asp Gln Ala Trp Arg Glu Pro Ile Thr Ala Ala Leu Ala Gln Ala Gly
 115 120 125

Leu Leu Glu Pro Lys Asp Val Asp Leu Leu Asn Ile Thr Ser Met Ala
 130 135 140

Cys Pro Ala Leu Pro Leu Cys Pro Leu Ala Gln Thr Glu Ala Glu Arg
 145 150 155 160

Gly Ile Leu Pro Ile Leu Lys Arg Ile Arg Ala Val Phe Asp Lys Val
 165 170 175

Gly Ile Lys Asp Glu Glu Ser Val Val Val Arg Ile Thr Gly Cys Pro
 180 185 190

Asn Gly Cys Ala Arg Pro Tyr Met Ala Glu Val Gly Phe Val Gly Asp
 195 200 205

Gly Pro Asn Ser Tyr Gln Ile Trp Leu Gly Gly Thr Pro Asn Gln Thr
 210 215 220

Thr Leu Ala Glu Thr Phe Met Asn Lys Val Lys Leu Gln Asp Ile Glu
 225 230 235 240

Lys Val Leu Glu Pro Leu Phe Ser Tyr Trp Asn Ser Thr Arg Gln Glu
 245 250 255

Gly Glu Ser Phe Gly Ser Phe Thr Asn Arg Met Gly Phe Glu Gln Leu
 260 265 270

Lys Glu Val Val Asn Lys Trp Glu Gly Ser Ala Ser Ala Ala
 275 280 285

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 <212> PRT
 <213> Zea mays

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Ala Pro Pro Ala Ala Ala Arg Pro Gly Gly Ala Ser Ala Gly Ser Ile
 35 40 45

Arg Ala Val Ser Ala Pro Ala Lys Lys Asp Ala Ser Glu Val Lys Arg
 50 55 60

Ser Lys Val Glu Ile Ile Lys Glu Lys Ser Asn Phe Leu Arg Tyr Pro
 65 70 75 80

Leu Asn Glu Glu Leu Val Ser Glu Ala Pro Asn Ile Asn Glu Ser Ala
 85 90 95

Val Gln Leu Ile Lys Phe His Gly Ser Tyr Gln Gln Thr Asp Arg Asp
 100 105 110

Val Arg Gly Gln Lys Asn Tyr Ser Phe Met Leu Arg Thr Lys Asn Pro
 115 120 125

Cys Gly Lys Val Pro Asn Gln Leu Tyr Leu Ala Met Asp Thr Leu Ala
 130 135 140

Asp Glu Phe Gly Ile Gly Thr Leu Arg Leu Thr Thr Arg Gln Thr Phe
 145 150 155 160

Gln Leu His Gly Val Leu Lys Lys Asn Leu Lys Thr Val Leu Ser Thr
 165 170 175

Val Ile Lys Asn Met Gly Ser Thr Leu Gly Ala Cys Gly Asp Leu Asn
 180 185 190

Arg Asn Val Leu Ala Pro Ala Ala Pro Tyr Val Lys Lys Asp Ile Leu
 195 200 205

Phe Ala Gln Gln Thr Ala Glu Asn Ile Ala Ala Leu Leu Thr Pro Gln
 210 215 220

Ser Gly Ala Tyr Tyr Asp Leu Trp Val Asp Gly Glu Lys Ile Met Ser
 225 230 235 240

Ala Glu Glu Pro Pro Glu Val Thr Lys Ala Arg Asn Asp Asn Ser His
 245 250 255

Gly Thr Asn Phe Pro Asp Ser Pro Glu Pro Ile Tyr Gly Thr Gln Tyr
 260 265 270

Leu Pro Arg Lys Phe Lys Val Ala Val Thr Ala Ala Gly Asp Asn Ser
 275 280 285

Val Asp Ile Leu Thr Asn Asp Ile Gly Val Val Val Val Ser Asp Asp
 290 295 300

Ala Gly Glu Pro Ile Gly Phe Asn Ile Tyr Val Gly Gly Gly Met Gly
 305 310 315 320

Arg Thr His Arg Val Glu Thr Thr Phe Pro Arg Leu Ala Asp Pro Leu
 325 330 335

Gly Tyr Val Pro Lys Glu Asp Ile Leu Tyr Ala Ile Lys Ala Ile Val
 340 345 350

Val Thr Gln Arg Glu Asn Gly Arg Arg Asp Asp Arg Lys Tyr Ser Arg
 355 360 365
 Met Lys Tyr Met Ile Asp Arg Trp Gly Ile Asp Arg Phe Arg Ala Glu
 370 375 380
 Val Glu Lys Tyr Tyr Gly Lys Lys Phe Glu Ser Phe Arg Pro Leu Pro
 385 390 395 400
 Glu Trp Gln Phe Asn Ser Tyr Leu Gly Trp Gln Glu Gln Gly Asp Gly
 405 410 415
 Lys Leu Phe Tyr Gly Val His Val Asp Asn Gly Arg Val Gly Gly Gln
 420 425 430
 Ala Lys Lys Thr Leu Arg Glu Ile Ile Glu Lys Tyr Asn Leu Asp Val
 435 440 445
 Ser Ile Thr Pro Asn Gln Asn Leu Ile Leu Cys Gly Ile Asp Gln Ala
 450 455 460
 Trp Arg Glu Pro Ile Thr Thr Ala Leu Ala Gln Ala Gly Leu Leu Glu
 465 470 475 480
 Pro Lys Asp Val Asp Pro Leu Asn Leu Thr Ala Met Ala Cys Pro Ala
 485 490 495
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 Pro Ile Leu Lys Arg Ile Arg Ala Val Phe Asn Lys Val Gly Ile Lys
 515 520 525
 Asp Ser Glu Ser Val Val Arg Ile Thr Gly Cys Pro Asn Gly Cys
 530 535 540
 Ala Arg Pro Tyr Met Ala Glu Leu Gly Phe Val Gly Asp Gly Pro Lys
 545 550 555 560
 Ser Tyr Gln Ile Trp Leu Gly Gly Thr Pro Asn Gln Ser Thr Leu Ala
 565 570 575
 Glu Ser Phe Met Asp Lys Val Lys Leu Asp Asp Ile Glu Lys Val Leu
 580 585 590
 Glu Pro Leu Phe Thr Tyr Trp Asn Gly Thr Arg Gln Glu Gly Glu Ser
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 610 615 620
 Val Asn Lys Trp Ala Glu Ser Pro Ser Ala Ala
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 <213> Nicotiana tabacum

<400> 8

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20 25 30

Ser Asn Ser Leu Leu Leu Ser Arg Arg Leu His Val Phe Gln Ser Phe
35 40 45

Ser Pro Ser Asn Pro Ser Ser Ile Val Arg Ala Val Ser Thr Pro Ala
50 55 60

Lys Pro Ala Ala Val Glu Pro Lys Arg Ser Lys Val Glu Ile Phe Lys
65 70 75 80

Glu Gln Ser Asn Phe Ile Arg Tyr Pro Leu Asn Glu Glu Ile Leu Asn
85 90 95

Asp Ala Pro Asn Ile Asn Glu Ala Ala Thr Gln Leu Ile Lys Phe His
100 105 110

Gly Ser Tyr Met Gln Tyr Asp Arg Asp Glu Arg Gly Gly Arg Ser Tyr
115 120 125

Ser Phe Met Leu Arg Thr Lys Asn Pro Gly Gly Glu Val Pro Asn Arg
130 135 140

Leu Tyr Leu Val Met Asp Asp Leu Ala Asp Gln Phe Gly Ile Gly Thr
145 150 155 160

Leu Arg Leu Thr Thr Arg Gln Thr Phe Gln Leu His Gly Val Leu Lys
165 170 175

Lys Asn Leu Lys Thr Val Met Ser Thr Ile Ile Lys Asn Met Gly Ser
180 185 190

Thr Leu Gly Ala Cys Gly Asp Leu Asn Arg Asn Val Leu Ala Pro Ala
195 200 205

Ala Pro Phe Ala Lys Lys Asp Tyr Met Phe Ala Lys Gln Thr Ala Asp
210 215 220

Asn Ile Ala Ala Leu Leu Thr Pro Gln Ser Gly Phe Tyr Tyr Asp Val
225 230 235 240

Trp Val Asp Gly Glu Lys Val Met Thr Ala Glu Pro Pro Glu Val Val
245 250 255

Lys Ala Arg Asn Asp Asn Ser His Gly Thr Asn Phe Pro Asp Ser Pro
260 265 270

Glu Pro Ile Tyr Gly Thr Gln Phe Leu Pro Arg Lys Phe Lys Ile Ala
275 280 285

Val Thr Val Pro Thr Asp Asn Ser Val Asp Ile Phe Thr Asn Asp Ile
290 295 300

Gly Val Val Val Val Ser Asn Glu Asp Gly Glu Pro Gln Gly Phe Asn
305 310 315 320

Ile Tyr Val Gly Gly Gly Met Gly Arg Thr His Arg Met Glu Thr Thr
 325 330 335
 Phe Pro Arg Leu Ala Glu Pro Leu Gly Tyr Val Pro Lys Glu Asp Ile
 340 345 350
 Leu Tyr Ala Val Lys Ala Ile Val Val Thr Gln Arg Glu Asn Gly Arg
 355 360 365
 Arg Asp Asp Arg Arg Tyr Ser Arg Leu Lys Tyr Leu Leu Ser Ser Trp
 370 375 380
 Gly Ile Glu Lys Phe Arg Ser Val Thr Glu Gln Tyr Tyr Gly Lys Lys
 385 390 395 400
 Phe Gln Pro Cys Arg Glu Leu Pro Glu Trp Glu Phe Lys Ser Tyr Leu
 405 410 415
 Gly Trp His Glu Ala Gly Asp Gly Ser Leu Phe Cys Gly Leu His Val
 420 425 430
 Asp Asn Gly Arg Val Lys Gly Ala Met Lys Lys Ala Leu Arg Glu Val
 435 440 445
 Ile Glu Lys Tyr Asn Leu Asn Val Arg Leu Thr Pro Asn Gln Asn Ile
 450 455 460
 Ile Leu Cys Asn Ile Arg Gln Ala Trp Lys Arg Pro Ile Thr Thr Val
 465 470 475 480
 Leu Ala Gln Gly Gly Leu Leu Gln Pro Arg Tyr Val Asp Pro Leu Asn
 485 490 495
 Leu Thr Ala Met Ala Cys Pro Ala Phe Pro Leu Cys Pro Leu Ala Ile
 500 505 510
 Thr Glu Ala Glu Arg Gly Ile Pro Asp Ile Leu Lys Arg Val Arg Ala
 515 520 525
 Ile Phe Glu Arg Val Gly Leu Lys Tyr Ser Glu Ser Val Val Ile Arg
 530 535 540
 Ile Thr Gly Cys Pro Asn Gly Cys Ala Arg Pro Tyr Met Ala Glu Leu
 545 550 555 560
 Gly Leu Val Gly Asp Gly Pro Asn Ser Tyr Gln Ile Trp Leu Gly Gly
 565 570 575
 Thr Pro Asn Gln Thr Ser Leu Ala Lys Thr Phe Lys Asp Lys Leu Lys
 580 585 590
 Val Gln Asp Leu Glu Lys Val Leu Glu Pro Leu Phe Phe His Trp Arg
 595 600 605
 Arg Lys Arg Gln Ser Lys Glu Ser Phe Gly Asp Phe Thr Asn Arg Met
 610 615 620
 Gly Phe Glu Lys Leu Gly Glu Phe Val Glu Lys Trp Glu Gly Ile Pro
 625 630 635 640

Glu Ser Ser Ser Arg Tyr Asn Leu Lys Leu Phe Ala Asp Arg Glu Thr
645 650 655

Tyr Glu Ala Met Asp Ala Leu Ala Ser Ile Gln Asp Lys Asn Ala His
660 665 670

Gln Leu Ala Ile Glu Val Val Arg Asn Tyr Val Ala Ser Gln Gln Asn
675 680 685

Gly Lys Ser Met Asp
690